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EFFECT OF MOISTURE CONTENT ON THE POWER REQUIRED TO SAW LOGS[1]

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That individual logs require differing amounts of power for sawing has long been known. Many theories have been advanced to account for this variation in power requirement. Some explanations are based on the mechanics of the individual mill, but others depend on the physical properties of the log being cut. Undoubtedly several factors could be responsible for the observed differences in power requirements. A partial list of contributing factors includes the following: size of saw, number of teeth, speed of saw, rate of feed, species of tree, density of wood, diameter of log, and the moisture content of the log at the time of sawing. Only the effect of the last named factor, moisture content of the log, is considered in this report.

The observation that moisture content affects power consumption has been based primarily on the speed at which different logs could be fed into the headsaw. It is generally supposed that the moisture in green logs acts as a lubricant and reduces the amount of power lost through friction. Also, it is well known that wood is softer and less resistant when the cell walls are saturated; hence less power is needed to saw green logs.

Experimental Procedure

A newly felled ponderosa pine tree was bucked into three 16-foot logs and hauled to the mill storage area. These logs were then placed on preservative-treated timbers elevated 18 inches above the ground; the log ends faced due east and west and the logs were laid about 3 feet apart. Each log was subjected to a different treatment: log 1, the control, received no treatment; the end surfaces of log 2 were sprayed continuously with water; and the end surfaces of log 3 were covered with rubber caps, kept filled with water. The bark surfaces were not wetted, but all debarked areas were painted with asphalt paint to prevent loss of moisture.

1/ This paper reports a study conducted by Helmuth Resch, sponsored by the Intermountain Forest and Range Experiment Station, in cooperation with the J. Neils Lumber Company of Libby, Montana.

The logs were stored in this manner for approximately 2 months, and at periodic intervals increment borings were made for moisture content determinations. Borings were made at the middle and approximately 2 feet from the east end of each log and spaced so that the longitudinal movement of the log moisture would not be appreciably affected. After removal of the cores, the holes were plugged with preservative-treated wood. For each core, the moisture content was measured in the first inch of sapwood, the remainder of the sapwood, and in the heartwood. These measurements are shown in table 1.

Table 1.--Moisture content at the ends and center of three 16-foot ponderosa pine logs during storage

Log number	Storage period	Percent moisture content: Middle of log: First inch of sapwood	Middle of log: Remainder sapwood	Middle of log: Heartwood	Two feet from log end: First inch of sapwood	Two feet from log end: Remainder sapwood	Two feet from log end: Heartwood
	Days	Percent	Percent	Percent	Percent	Percent	Percent
1	1	125	108	27	--	--	--
	8	81	95	25	119	92	28
	15	117	47	29	117	78	22
	22	117	48	26	107	91	27
	29	108	90	27	99	86	30
	52	131	105	31	134	105	31
	64	132	91	29	122	98	29
Av.		116	83	28	116	92	28
2	1	166	163	28	--	--	--
	8	178	138	27	186	150	30
	15	191	153	32	195	138	29
	22	193	149	33	164	159	31
	29	187	134	33	172	139	31
	52	196	144	34	191	167	34
	64	167	142	36	186	166	33
Av.		183	146	32	182	153	31
3	1	188	167	26	--	--	--
	8	180	166	25	194	190	29
	15	198	163	28	195	156	27
	22	215	121	32	196	166	27
	29	177	154	28	201	164	27
	52	209	172	34	194	165	30
	64	182	155	35	218	169	33
Av.		193	157	30	200	168	29

At the completion of the storage period, the logs were taken to the mill for sawing. The logs were sawed successively and the same sawing method was used for each log. The procedure was to slab each log on opposite faces and then to saw inch boards until only a cant 10 inches wide remained. The cant was then laid on a cut face, and inch lumber was sawed until the pith was visible; thereafter the cant was turned 180° and the last face was cut into inch lumber. The power needed to saw the 10-inch wide cants into boards was measured with a recording ammeter and a watt-hour meter. Records of these measurements are shown in table 2.

Table 2.--Power consumed in sawing three 10-inch wide ponderosa pine cants subjected to different treatments

Power requirements	Log 1	Log 2	Log 3
Amperes per line	0.332	0.276	0.283
As percent of dry log	100	83	85
Watt hours per line	164	129	136
As percent of dry log	100	79	83

Discussion

The records of the moisture content measurements show considerable variation for the control log (table 1). This variation resulted in part from weather conditions immediately preceding the successive borings. After 1 day on the storage rack, initial checking was observed in the ends of the control log. All the moisture content determinations of logs 2 and 3 were slightly greater than the fiber saturation point, approximately 28 percent; hence no checks developed in the ends of these logs. The moisture content determinations for the sapwood of these logs were all well above the fiber saturation point, but the moisture content of the heartwood fluctuated around the fiber saturation point.

The power measurements, both ampere and watt-hour, indicate that the moisture content of the logs markedly affected the power consumption (table 2). The control log had the lowest average moisture content and required the most power for sawing. Log 2, end sprinkled, maintained the highest average moisture content and required the least amount of power. Log 3, end-capped, was intermediate, both in average moisture content and in power consumption.

Conclusions

The limited data from this investigation warrant the following tentative conclusions:

1. Sprinkling logs increases their moisture content; and this moisture, in turn, markedly reduces the amount of power necessary to saw them.

2. Sprinkling also reduces end checking and the development of blue stain.

3. Additional controlled sawing experiments appear to be justified and desirable.

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